Advanced Recycle—Why Now?

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INTRODUCTION

As plans for construction of the next round of light-water-cooled nuclear power plants (LWRs) move forward, what to do with used fuel remains in limbo. The future of Yucca Mountain, and thus the plans for direct disposal of used LWR fuel, is cloudy, yet for over 15 years there has been no significant effort in the United States on alternatives to Yucca Mountain. In the face of this, there are concerned citizens, well beyond those of us who have been involved in developing recycle technologies, who are diligently using their own time and resources to promote the idea of intelligent recycle.[1],[2] Is this foolishness, a distraction from the push for new LWRs, or a true, critical need?

FOUR REASONS TO PURSUE INTELLIGENT RECYCLE

As a practical matter, there is no way a recycling system can be a timely substitute for the urgently needed new fleet of LWRs. Rather, advanced recycle is an essential component the nuclear renaissance for four fundamental reasons:

Nuclear waste. Intelligent recycle provides a comprehensive way to manage the used fuel, answering the often-raised argument that there should be no further use of nuclear power until there is a solution to the "nuclear waste problem." For example, California prohibits the development of new nuclear energy facilities until there is an affirmative finding on reprocessing or disposal of used nuclear fuel.[3] While there are various technically feasible ways to deal with the used fuel other than by recycling in fast reactors, the combination of politics, irrational fear of low-level radiation, and inefficient resource utilization make them unacceptable as long-term solutions.

Energy security. Intelligent recycle extends the resource value of uranium by several orders of magnitude, making fission energy virtually inexhaustible.[4] An LWR without recycle uses less than 1% of the energy content of the ore—obviously a wildly inefficient use of resources. Traditional reprocessing (PUREX and MOX) improves utilization only marginally and is associated with commerce in separated plutonium, a proliferation challenge. A 100-fold increase in efficiency would provide absolute energy security. The mined and stockpiled uranium *now on hand* can meet our national energy requirements for centuries.

Proliferation. Advanced recycle simplifies the management of weapons-usable materials and their sources, facilitating efforts to limit the proliferation of nuclear weapons—perhaps advanced recycle's most misunderstood (and misrepresented) feature. Intelligent recycle:

- does away with commerce in separated plutonium;
- provides an immediate, efficient way to rapidly denature and eventually destroy excess weapons material;
- displaces, and ultimately eliminates, the need to enrich uranium;
- provides a market for used LWR fuel;
- is compatible with rigorous safeguards and tracking technologies.
- provides a clear alternative to PUREX reprocessing, and is a basis for negotiating new safeguards arrangements compatible with today's political realities.

Commercial development. Intelligent recycle provides a constructive way for the government to support the nuclear renaissance without interfering in the commercial development and marketing of advanced nuclear power plants, and without compromising federal regulators' ability to assure the safe deployment of nuclear power. Such a policy can stimulate a strong energy economy that does not need indefinite subsidies.

HOW TO PROCEED

Done right, advanced recycle is composed of four components:

(a) A plant or plants to recover actinides from used LWR fuel. There is some debate about whether to build a single, large-scale plant owned and operated by the government, or smaller distributed units. Both appear feasible, but neither is needed to initiate deployment of advanced recycle.

(b) Fast reactors fueled with this recovered material. We know how to build fast reactors,[5] and existing designs have had preliminary licensing review. One or more should be built immediately, to service the third leg of this technology. Initial fueling can come from combining excess weapons material with depleted uranium.

(c) Facilities to recycle the fast reactor fuel. The fast-reactor recycle has been demonstrated on a small scale,[6] but insufficient work has been done to establish its commercial viability. This is on the critical path, and design and development should proceed immediately, including demonstration of the appropriate safeguards techniques.

(d) A way to dispose of the residual wastes. Processing the modest amount of waste (about a ton per GWe-yr, whose radioactivity becomes inconsequential within 500 years) appears straightforward (relative to disposing of used LWR fuel), and can be credibly left for later demonstration.

In comparison with alternative U.S. approaches to dealing with the "nuclear waste problem," this approach requires only a relatively simple, modest-scale demonstration before it can be deployed.

LWRs can address the urgent, near-term need for energy, and they are technologically "shovel ready." Advanced recycle will function comfortably and symbiotically at the back end of the LWR fuel cycle. Freed of the uncertainty about what to do with their used fuel, the nuclear industry can make credible long term plans and commitments.

REFERENCES

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